Title: It's Batty!!

Brief Overview:

Students will share statistical experiences with Batman. Various graphs will be created and interpreted. The students will determine how to read and match various data items in a graph based on given data. As a result, the students will create a graph based on the data and write a descriptive story about Batman's heart rate while he chases his enemies.

Links to Standards:

- **Mathematics as Problem Solving**
  Students will use data to solve and analyze statistical data.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically. They will read, write, and analyze data and graphs. By writing a story, students will communicate their ability to interpret a graph.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to reason mathematically. They will use their reasoning skills to construct appropriate graphs and interpret the existing graphs. They will be required to justify their responses.

- **Mathematical Connections**
  Students will draw on their knowledge of daily activities to interpret various graphs.

- **Computation and Estimation**
  Students will use their computational skills to complete a data table. They will calculate the fuel usage given mileage rates and total costs of the weekly fuel consumption. They will also compute percent of commission.

- **Patterns and Functions**
  Students will describe trends of a given graph.

- **Statistics**
  Students will organize data in a table. They will choose an appropriate graph to represent the data. They will interpret existing graphs.

- **Probability**
  In an extension activity, students can determine the probability of the Penguin and Catwoman having a penguin baby using punnett squares.

Grade/Level:

Grades 6-8

Duration/Length:

These activities will take approximately 3 - 5 days to complete.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Mean calculation
- Data organization
- Graph creation and interpretation
- Commission calculation

Objectives:

Students will:

- demonstrate graph interpretation and reasoning skills through interpretive questions and creative writing activities.
- construct appropriate graphs.

Materials/Resources/Printed Materials:

- Calculator
- Worksheets
- Assessment activities
- Extension worksheet

Development/Procedures:

Day 1 Present the unit to the students. Clarify any questions they may have. Complete Worksheet 1 - Complete data table, construct graph, and interpretive questions.

Day 2 Worksheet 2 - Graph interpretation.

Day 3 Assessment - Graph construction and creative interpretation (Activities 1 and 2).

Performance Assessment:

Students will be evaluated on constructing the appropriate graph. They will write a creative story based on a given graph. A rubric will be used to score these activities.

Extension/Follow Up:

This is an optional activity that can be used for an enrichment activity. Students will determine the probability of the Penguin and Catwoman having a penguin baby.

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WORKSHEET 1

Batman is chasing the Joker within and around Gotham City. As a result of his continual chase, the Batmobile uses fuel at a rate of 4 miles per gallon in the city and 7 miles per gallon on the highway. Complete the chart below to help you answer the following questions. Round your answers to the nearest tenth.

BATMOBILE MILEAGE

Day	City Miles	Gallons Used in City	Highway Miles	Gallons Used in Highway	Total Gallons Used
Monday	30		60		
Tuesday	36		100		
Wednesday	46		84		
Thursday	50		90		
Friday	65		88		
Saturday	80		110		
Sunday	78		80		

Data Representation:

Construct an appropriate graph to display the trends of Batman's fuel usage (starting with Monday). Be sure to distinguish between city and highway usage. Remember to include TAILS: a proper title, axis, increments, labels, spacing, and a key if necessary.

Questions:

1. On which day does Batman do most of his city traveling?_____
2. On which day does Batman do most of his highway traveling?_____
3. Which day results in putting the most mileage on the Batmobile?_____
4. Find the mean city miles traveled during the week._____
5. Find the mean highway miles traveled during the week._____
6. For several hours on one of these days, the Batmobile was in the garage for a tune-up . Based on the data, explain which day that would be most likely?

7. The Batmobile uses super octane gasoline ($1.50 per gallon). Find the weekly cost of gasoline for the Batmobile. Explain how you arrived at your answer.

8. Describe Batman's traveling trends for the week on the city streets *AND* on the highway.

9. What factors may contribute to either of these trends?

10. Using the graph, predict the Batmobile's fuel usage on Monday. Justify your response.

ANSWER SHEET **WORKSHEET 1**

BATMOBILE MILEAGE

Day	City Miles	Gallons Used in City	Highway Miles	Gallons Used in Highway	Total Gallons Used
Monday	30	7.5	60	8.6	16.1
Tuesday	36	9	100	14.3	23.3
Wednesday	46	11.5	84	12	23.5
Thursday	50	12.5	90	12.9	25.4
Friday	65	16.3	88	12.6	28.9
Saturday	80	20	110	15.7	35.7
Sunday	78	19.5	80	11.4	30.9
	385	96.3	612	87.5	183.3

Data Representation:

Double line graph is most appropriate to identify the trends. Check rubric for scoring criteria.

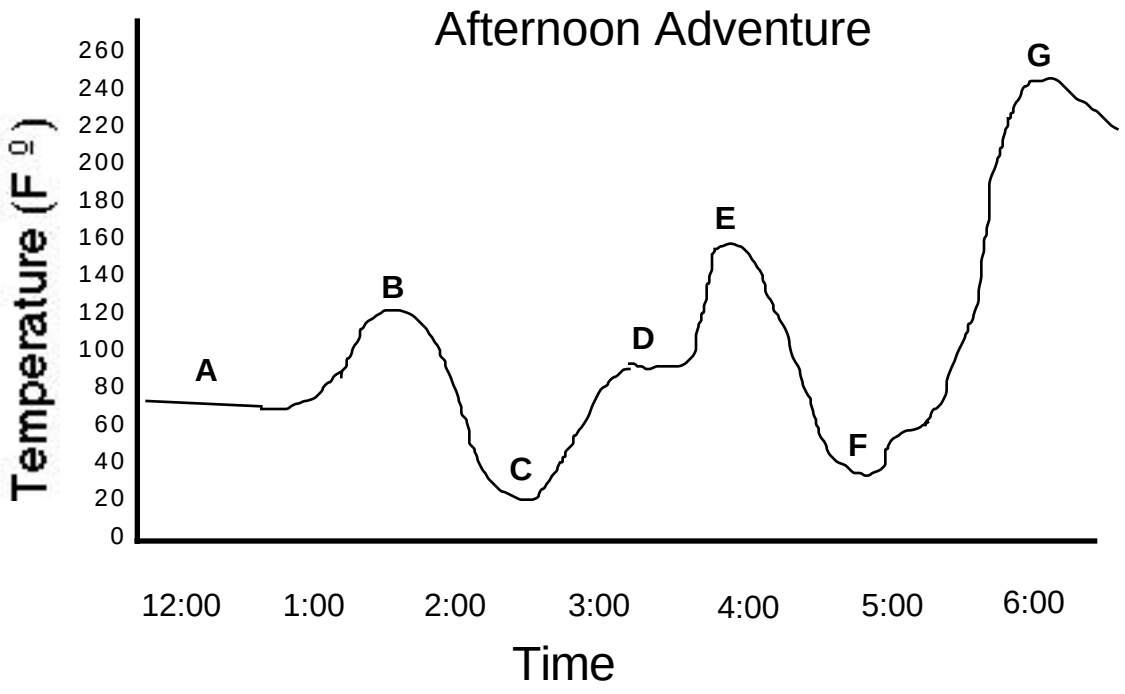
Questions:

1. Saturday (80 miles)
2. Saturday (110 miles)
3. Saturday (190 miles)
4. 55 miles
5. 87.4 miles
6. Monday. This day has the least mileage (90 miles).
7. 183.3 * $1.50 = $275.70
8. city--steady and then increased on the weekend; highway-- no real trend.
9. answers may vary

WORKSHEET 2

This spring has been a relatively quiet time for Batman and his companions. Early this morning Batman received the news that the Joker returned to Gotham City. The Joker lead Batman through the city and into several challenging predicaments. The graph below is a representation of Batman's activities in the Batmobile on this warm summer day. These readings were taken from the Batmobile's temperature sensor on the outside. Use common temperatures (i.e. freezing - 32 degrees Fahrenheit, boiling - 212 degrees Fahrenheit, body temperature - 98.6 degrees Fahrenheit) and the graph to help you match the given situations to the labeled portions of the graph.

1. Patrolling Main Street _____
2. Driving through a burning building _____
3. Checking messages in the Bat Cave _____
4. Going through a hot car wash _____
5. Staking out the Joker, sitting in the bright sun _____
6. Frozen by Iceman _____
7. Taking lunch break under a shady tree _____



Interpretive Questions:

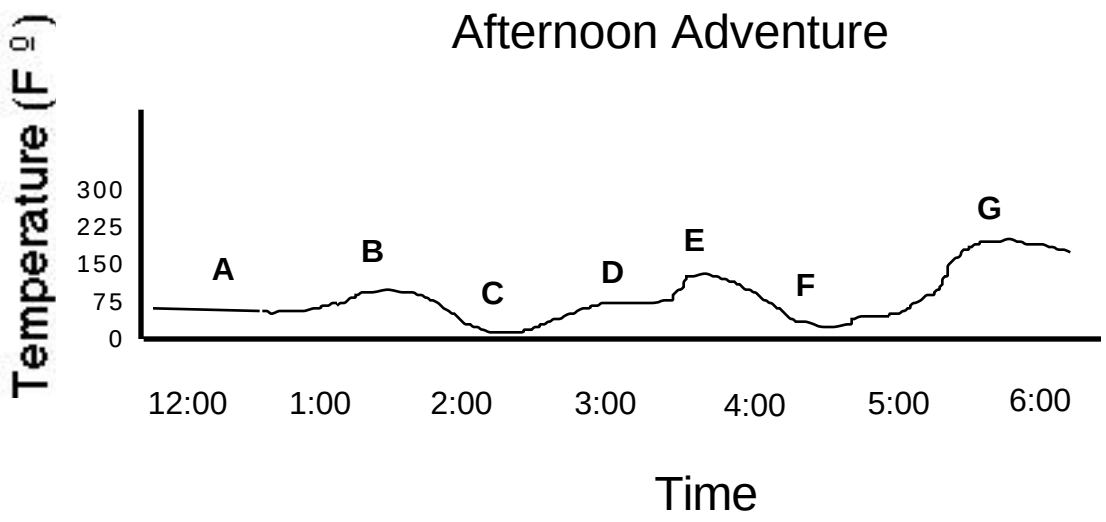
1. At about what time is the Batmobile the hottest? The coldest?
2. What is the approximate temperature of the Batmobile at 5:00?
3. Which two events were the easiest to match? What factors helped you to match these events.

4. Which two events were the trickiest to match? What factors helped you to match these events.

5. At which event did Batman spend most of his time ? About how much time did he spend there? Explain.

Choosing a Graph:

The Batmobile requires a new coat of super protective paint. In order to determine which paint would best suit the Batmobile, Batman's butler used the same temperature data as above to construct the following graph.

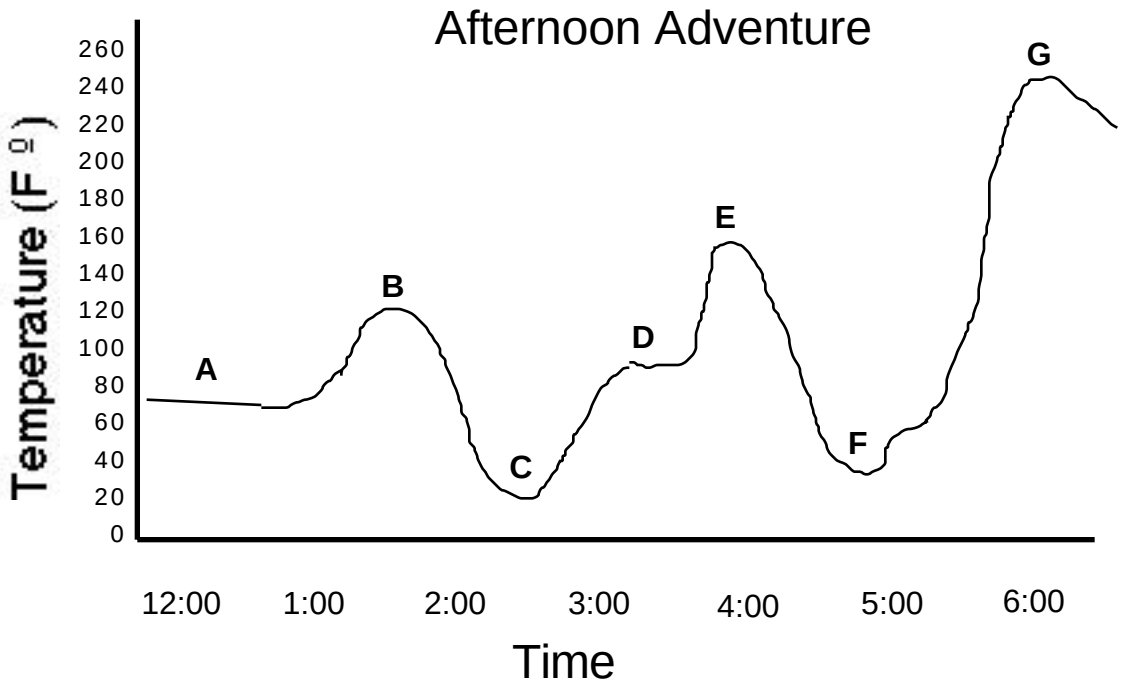


1. Does this look like a graph of the same data? Explain.

2. Which graph would provide Batman with a better representation of the data? Justify your selection.

ANSWER SHEET WORKSHEET 2

1. Patrolling Main Street ___D____
2. Driving through a burning building ___G____
3. Checking messages in the Bat Cave ___F____
4. Going through a hot car wash ___E____
5. Staking out the Joker, sitting in the bright sun ___B____
6. Frozen by Iceman ___C____
7. Taking lunch break under a shady tree ___A____



Interpretive Questions:

1. Answers will vary.
2. Answers will vary.
3. Event A -- taking lunch break under shady tree...about 1 hour.

Choosing a Graph:-

This is the same data...the first graph is a better representation. Explanations will vary.

PERFORMANCE ASSESSMENT

INTRODUCTION

You have been studying problems relating to Batman's recent attempts to stop various villains. Batman has run into recent financial difficulties. Due to the recent incidents with the Joker, he has decided to accept commissions for his recent promotion of certain products. He is going to stop at his agent's house to collect a few commissions to assist him with his expenses.

ACTIVITY ONE

Since Batman is so busy trying to stop the terrorizing of Gotham City, he requests your help in organizing his data and determining the amount of commission that he should receive. He has a few requests that you need to follow to meet his requirements. He would like the amount of commission earned ordered from the least to the greatest in the table provided. He requests that you construct an appropriate graph to display the comparison between the commercials and the advertisements of each product.

Items	Commission Rate	Total Sales
Soda advertisement	10%	$120,000
Breakfast food advertisement	5%	$300,000
Chips commercials	8%	$150,000
Soda commercials	12%	$450,000
Chips advertisement	15%	$625,000

Item	Commission Earned

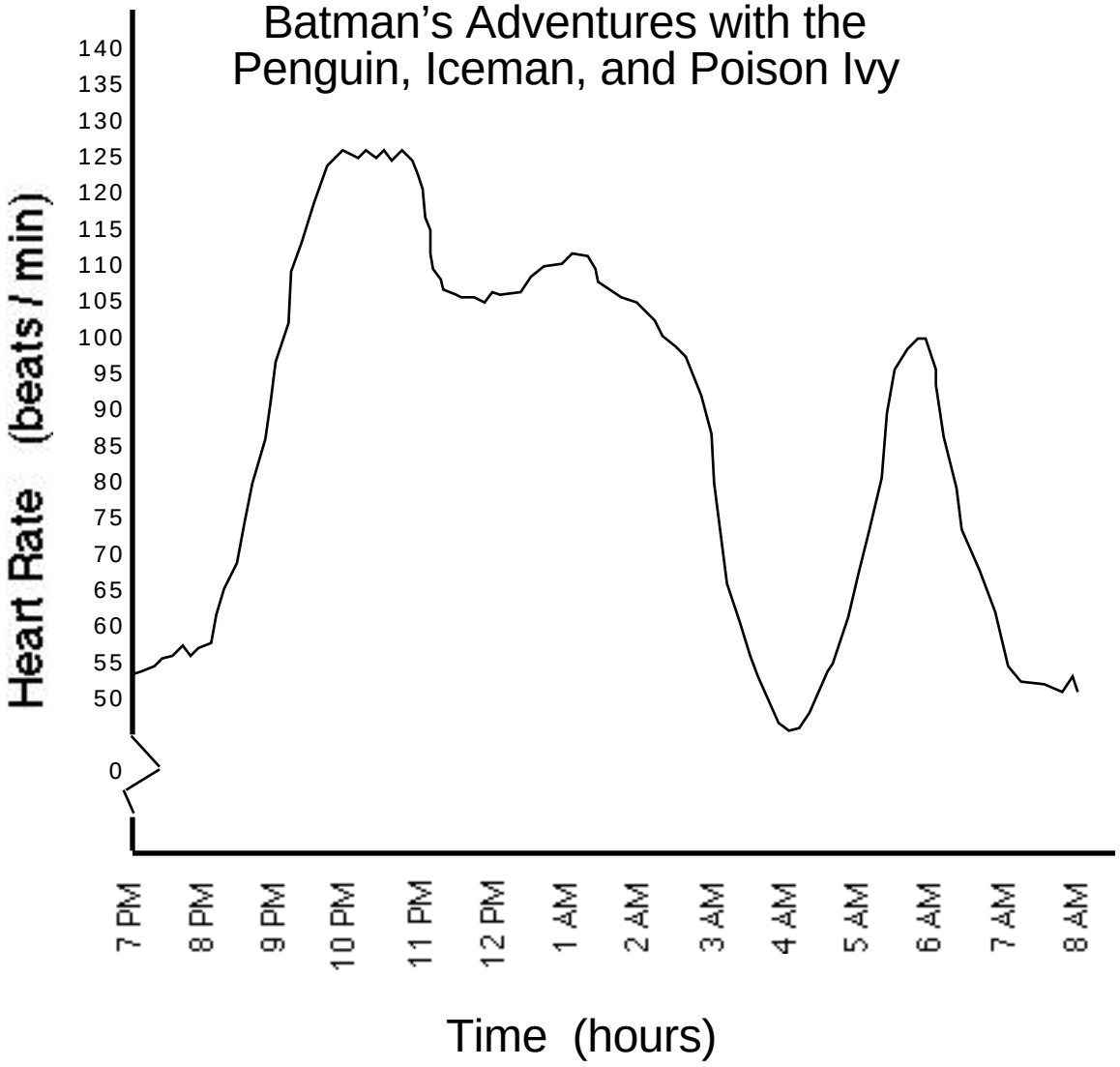
Questions:

1. Batman would like to cut back on his endorsements. Which item do you think Batman should eliminate, the commercials or the advertisements? Justify your reasoning.

2. Batman has gone even further to say that he will probably eliminate all but one activity to cover his most recent expenses. Which one do you think he should continue to do to maximize his efforts? Justify your choice.

ACTIVITY 2

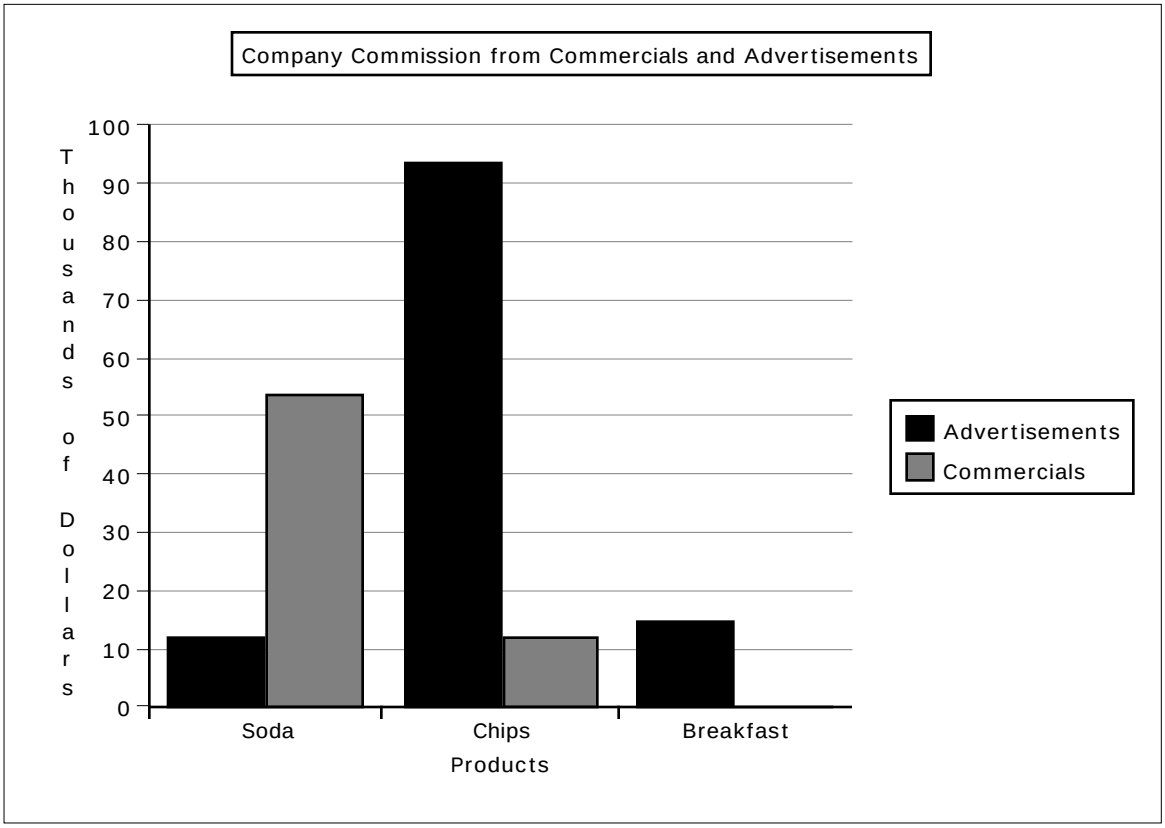
Write an original story based on the following graph. Please be very creative and descriptive in your analysis. Remember this is a story and the content and length should be reflecting such.



Helpful hint--- a persons AVERAGE heart rate is 70 beats per minute.

ANSWER KEY FOR ACTIVITY 1

Item	Commission Earned
Soda Ad.	0.10 * $120,000 = $12,000
Chip Comm.	0.08 * $150,000 = $12,000
Breakfast Ad.	0.05 * $300,000 = $15,000
Soda Comm.	0.12 * $450,000 = $54,000
Chips Ad.	0.15 * $625,000 = $93,750



ACTIVITY 2
Scoring Rubric For Mathematics Writing

3
- Shows a thorough understanding of the concepts
- Uses appropriate strategies
- Computations are correct
- Written explanation is exemplary
- Goes beyond the requirements of the problem

2
- Shows an understanding of the concepts
- Uses appropriate strategies
- Computations are mostly correct
- Satisfies all requirements of the problem

1
- Shows an understanding of most concepts
- May not use appropriate strategies
- Computations are mostly correct
- Written explanation is satisfactory
- Satisfies most requirements of the problem

0
- Shows little understanding of concepts
- May not use appropriate strategies
- Computations are not correct
- Written explanation is not satisfactory
- Does not satisfy the requirements of the problem

ACTIVITY 1
Scoring Rubric for Creating A Graph

3	• Contains an appropriate title • Both axes are labeled correctly • Consistent numerical scale are accurate • Data is accurately displayed • Keys to symbols is correct (if applicable)
2	• Contains a title • One axis is labeled correctly • Minor errors in numerical scales • Data displayed contain minor errors • Keys to symbols are correct (if applicable)
1	• Title is missing or inappropriate • Label for axes is missing or incorrect • Numerical scales are inconsistent • Data displayed contains major errors • Key to symbols is missing (if applicable)
0	• Blank • Off task/ off topic • Unreadable/illegible

EXTENSION ACTIVITY

Genes determine our characteristics. They come in pairs, one from each of the parents. The following are the only possible outcomes.

Recessive	=	2 recessive genes
Dominant	=	2 dominant genes
Hybrid	=	1 dominant gene and one recessive gene

The Penguin decides that he wishes to get married. Catwoman is unknowingly selected to be his bride. The Penguin wishes to determine that, if a child is born, what is the probability that it will be a penguin?

Calculate the possible combinations given the following traits.

	C	p
p		
p		

What is the probability of the child being a:

1. Catwoman (dominant)
2. Penguin (recessive)
3. Mix (hybrid)

	C	C
p		
p		

What is the probability of the child being a:

1. Catwoman (dominant)
2. Penguin (recessive)
3. Mix (hybrid)

Do you recommend that the Penguin and Catwoman have children (that is if she agrees to marry him and they do not wish to have baby penguins)?